



Journal of Student Research on Puget Sound

The collected reports of the student scientific explorations aboard the *SV Carlyn*

Salish Sea Expeditions is a catalyst for students in their inquiry of Puget Sound through boat based-scientific exploration.

Comparing Plankton and Dissolved Oxygen Levels Near Populated and Non-Populated Areas of Puget Sound

Cascade Middle School - 8th Grade



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I. Title

Comparing Plankton and Dissolved Oxygen Levels Near Populated and Non-Populated Areas of Puget Sound

II. Abstract

Before our trip, our class predicted that there would be more dissolved oxygen in non-populated areas leading to more plankton in those areas. Sampling took place over a two-day period in Puget Sound with samples taken near Seattle and Blake Island. Data collection focused on: dissolved oxygen, phytoplankton and zooplankton levels, temperature, and salinity. Different tools were used to collect and examine our samples such as a Sonde, Niskin bottle, plankton nets, and microscopes. From our study we discovered more plankton and dissolved oxygen in non-populated areas leading us to accept our prediction. If we were to continue our study we would like to take more samples in various areas around the Puget Sound in order to make a more accurate conclusion.

III. Introduction

We chose to study plankton and dissolved oxygen after doing research about topics that affect the Puget Sound. The research brought up that Puget Sound has a variety of plankton and aquatic plants that produce dissolved oxygen. From our research we realized that populated areas encourage plant growth therefore destroying the production of dissolved oxygen due to too many plants. This led us to wonder how the loss of dissolved oxygen affected the levels of plankton near more populated areas.

Our experiment question was: What affects plankton in different parts of Puget Sound? We originally predicted that if the dissolved oxygen levels in populated and non-populated areas were compared then we would find more plankton in non-populated areas. This is because there will be more dissolved oxygen in non-populated areas because the dissolved oxygen is affected by fewer boats. We broke down the prediction into two parts because there were too many variables to test. The first part we predicted that there would be more dissolved oxygen in non-populated areas because the dissolved oxygen is undisturbed. The second part we predicted there would be more plankton in non-populated areas because plankton need dissolved oxygen.

IV. Experimental Design

We collected our sample data from four different places. The populated areas we sampled from were Elliot Bay and Alki Point. Our non-populated areas we sampled from were near the front of Blake Island and near the back of Blake Island. Samples from Elliot Bay and the back of Blake Island were taken in the morning, while samples from Alki Point and the front of Blake Island were taken in the afternoon.

The water depth for the first days sampling sites is not available, but for the back of Blake Island it was recorded at 142 feet and for Alki Point it was 20 feet. Neither day had any precipitation, but it was cold and windy. We recorded the wind with the Beaufort scale to be force 3 the first morning and afternoon with a force 2 the second morning decreasing to a force 1 in the afternoon. The

cloud cover for the first morning was 20% decreasing to 5% in the afternoon and the second morning was 21% increasing to 75% in the afternoon.

The following equipment was used to collect data from each of the four sample sites:

- Sonde:
 - o deployed at a depth of 18 meters
 - o collected data every second on dissolved oxygen, water temperature and salinity for 5 minutes
- Dissolved Oxygen probe:
 - o used on deck to measure the dissolved oxygen level of the water sample collected in the Niskin Bottle.
- Niskin Bottle:
 - o deployed at a depth of 7 meters
 - o collected water sample from that depth
- Phytoplankton Net:
 - o deployed at a depth of 7 meters
 - o collected phytoplankton for 5 minutes
- Zooplankton Net:
 - o deployed at a depth of 7 meters
 - o collected zooplankton for 5 minutes
- refractometer:
 - o used to determine the salinity of the water

During each deployment time the boat was made to “stop” so that there would be little movement from when the equipment was deployed to when it was brought back on deck.

To analyze our samples from the phytoplankton and zooplankton nets we used the strainer and graduated cylinder. First we took the water collected from one net and poured it over the strainer and into a dish. What was left in the strainer was then poured into the graduated cylinder as the strainer was washed off with some water from the squirt bottle. The graduated cylinder of plankton was then allowed to settle for at least 15 minutes before we recorded how much plankton had settled to the bottom of it.

As mentioned before we used the microscopes to look at why types of plankton we were collecting on the second day. We used droppers to try and get each plankton separate to look at them under the microscope. Once we found one, we used the plankton guide to try and identify it. The list of what we found is in the results section of this paper.

V. Results

Table 1: Dissolved Oxygen & Plankton Levels

Place	Area Type	Dissolved Oxygen (mg/L)	Zooplankton (ml)	Phytoplankton (ml)
Blake Island (Back)	Non-populated	6.0	17	2
Blake Island (Front)		6.3	1	2

Elliott Bay	Populated	5.9	5	2
Alki Point		6.1	data missing	1

In our first non-populated area, near the front of Blake Island, the dissolved oxygen level was 6.0 mg/L with 2 ml of phytoplankton and 17 ml of zooplankton. The second sample taken, near the back of Blake Island, found a dissolved oxygen level of 6.3 mg/L with 2 ml of phytoplankton and 1 ml of zooplankton. In the first populated area sampled, in Elliot Bay near Harbor Island, the dissolved oxygen level was 5.0 mg/L with 2 ml of phytoplankton and 5 ml of zooplankton. The second populated area, near Alki Point, found a dissolved oxygen level of 6.1 mg/L with 1 ml of phytoplankton and an estimated amount of 3-4 ml of zooplankton. The zooplankton level is estimated because the jar holding it got broken.

Overall we noticed that the dissolved oxygen level didn't change much between our populated and non-populated sampling sites. So there wasn't really a trend in dissolved oxygen. We did find that there was a little more phytoplankton in non-populated areas. For zooplankton we found that our one site had significantly more zooplankton than the others. In the non-populated areas there seems to be more zooplankton.

We looked at the plankton from the second day, back of Blake Island and Alki Point, and found a variety of types. There was a lot of phytoplankton and some zooplankton. We identified the following: amphipod, crab megalops, shrimp larva, oikopleura, copepod adult, polychaete larva, and crab zoea.

With the Sonde we were able to gather some data on the water temperature at each sampling site. On average it was about 12 degrees Celsius for an average depth of 12 meters. It also told us that the salinity for that depth on average for all sites was about 27 ppt.

VI. Discussion

Prediction #1

There will be more dissolved oxygen in non-populated areas because the dissolved oxygen in those areas are undisturbed.

Prediction #2

If there is more dissolved oxygen then there will be more plankton because plankton need dissolved oxygen.

We support our prediction because we found more phytoplankton, zooplankton, and dissolved oxygen in the non-populated areas we tested compared to the data we found in the populated areas. This means that there is probably more dissolved oxygen in the non-populated areas, and since there may be more dissolved oxygen there may be more plankton. For us in the more populated area of the Puget Sound then there is less dissolved oxygen leading to less plankton.

If we were to do this again we would like to change a few things about our data collection in order to be more accurate with our conclusion. We would like to have more sample sites to get data from. Those sample sites could come from the areas between the populated and non-populated areas we tested at. We would also like to deploy equipment at different times of the day besides once in the morning and in the afternoon. With deployment we would like to try it in certain and/or different tides too. If possible it would be helpful to have data collected over a longer period of time – by season in order to compare it.

In addition we would like to change a few things about our experimental design. We would like to sample in deeper water because the surface conditions may force the plankton farther down. Also plankton may be feeding or hiding at deeper levels. Our deployment methods we would like to change as well. The data collected could have been more accurate if we could collect at not such windy times where the boat was drifting, so we could be a deeper and more accurate location for sampling.

After conducting our research, questions we have for future science study are: Where does dissolved oxygen come from? Are there different amounts of plankton closer or farther from shore? Will we find different data closer or farther from shore? Does pollution affect dissolved oxygen levels? Is zooplankton or phytoplankton more dependent on dissolved oxygen?

VII. Cruise Summary

Overall, the boat trip was fun. We got to see and experience a lot on our trip. Here are a few highlights:

For the night half the group, the wind watch, camped on the shore of Blake Island in tents. The group was not alone as there were many black and white bandits (raccoons) that visited throughout various parts of the evening. On shore part of the group cooked up a pasta alfredo dish, accompanied by green salad and garlic bread for dinner, while the rest of the wind watch wrestled with setting up the tents and making sleeping arrangements. Meanwhile on the boat the other half of the group, the water watch, cooked a fabulous dinner of chicken enchiladas and macaroni and cheese accompanied by green salad. After the clean-up crews took care of the dishes the water watch rowed ashore for evening activities.

All together again, and in the dark, the group walked up towards the small grass field near the restrooms. There we played a game – Sam was “blinded” and Ruth had to direct him to find the “hidden” object. The trick – Ruth could only see the group (who wasn’t allowed to speak, only gesture) and couldn’t see where Sam was going. After many directions gone wrong, some spy moves by Sam and finally some good communication Sam found the flashlight and we went for a night hike.

On the night hike around the point of Blake Island we saw the full harvest moon and some constellations that some tried to identify. We stopped at the beach to play another quick game before heading back to the campfire and dessert. The back part of the group saw a seal pup left by its mother on the beach walking back to the campsite.

Back at the campsite there was nice warm fire and the wind watch made dessert for everyone. It was a fantastic chocolate fondue served with vanilla wafers, bananas, melon and strawberries (Yes, Bryant your chocolate is still missing). Everyone dipped in and enjoyed the warmth, company and a few scary stories. Finally bedtime came and everyone went to his or her respective sleeping areas.

It was fun working the sails and navigating the boat with the captain. We learned how to tie knots, navigate – figure out where we were and where we were going, steer the boat, put up sails and adjust the sails to where we were going. The crew and caption also taught us a little about how boats sail using the wind. It wasn’t that hard though it was really cold.

For weather preparation we were pretty prepared for it, but we did borrow a few warm hats and layers while sailing the boat. Under sail we saw some other wildlife other than on shore – there were sea lions on a buoy, seals swimming around, plankton and jellyfish. On shore in addition to the raccoons we did see some deer at night in the field by the bathrooms.